

# GRADUATE EDUCATION REFORM AND INTERNATIONAL MOBILITY OF SCIENTISTS IN JAPAN AND RELATED INFORMATION FOR KOREA

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## INTRODUCTION

Since the establishment of a system of higher education in Japan at the end of the 19th century, it has been one of the driving forces in leading Japan into industrialization and modernization. However, Japan has experienced great economic and social changes that now demand subsequent changes in the university system.

“University reform” is the key concept in understanding the current situation of higher education in Japan. The Basic Plan for Promotion of Science and Technology, which has just been initiated by the government, will be a great boost for the movement to reform university research. Korea, one of Japan’s neighbors, is also experiencing a similar kind of reform movement affecting its university and research systems.

Universities and colleges have played several roles in Japan: training researchers, teachers, and other types of professionals; carrying out research and development; and identifying prospective young people who might later play an important role in Japanese society. The character of these roles, however, is now changing greatly due to the massification of higher education and the increased sophistication of research in science and technology. The research and research training functions of universities need to be reevaluated and improved, while also responding to various educational demands by students of a mass higher education system in which more than 47 percent of the 18-year-old population now participates. It has become difficult for each individual institution to respond to these needs at the same time.

Within this changing environment, some reforms that can now be observed are competitive allocation of research funds, expansion of graduate training accompanied by new financial aid programs, encouragement of research cooperation with industry, and restructuring of research units at major universities. After discussing the reforms taking place in graduate education in Japan, a brief description is here given of recent trends in graduate education in Korea.

## NATURE OF GRADUATE EDUCATION REFORM IN JAPAN

Necessary reforms in graduate education have been discussed since the early 1970s, based on the idea that the system in Japan is very weak and inclined to train future academics rather than other types of professionals. The Ministry of Education, Science, Sports, and Culture (hereafter referred to as Monbusho) began introducing more flexibility through systemic reforms; it has devoted much effort to expanding the capacity of graduate schools and creating new programs at many national universities. A feature of graduate education policy recently introduced by Monbusho is a more competitive mode for obtaining research grants and other kinds of resources. For example, special competitive funds are made available both for graduate programs and graduate students. New types of fellowships fund individual prospective students, while other special funds provide institutional support for graduate programs. The effects of these policies will be seen in the near future.

Today, all national universities in Japan, as well as two-thirds of the private universities, have graduate programs. Graduate enrollment currently exceeds 170,000, including about 80,000 in science and engineering programs. This is more than 10 times the 1960 enrollment. For science and engineering, the number of students is 23 times larger.

## MASSIFICATION OF HIGHER EDUCATION AND THE DECLINE IN THE POPULATION OF 18-YEAR-OLDS

The research environment at universities has changed radically over the past years. The most important change has been the “massification” of higher education, which has made the traditional notion of the unity of research and teaching difficult to maintain. The reform and expansion of graduate education in Japan cannot be understood without mentioning the trend toward

massification of higher education at the undergraduate level. Graduate education has been recognized (by university faculties as well as by the government and industry) as a crucial device for avoiding problems, such as the lack of balance between research and teaching, caused by the massification of undergraduate education.

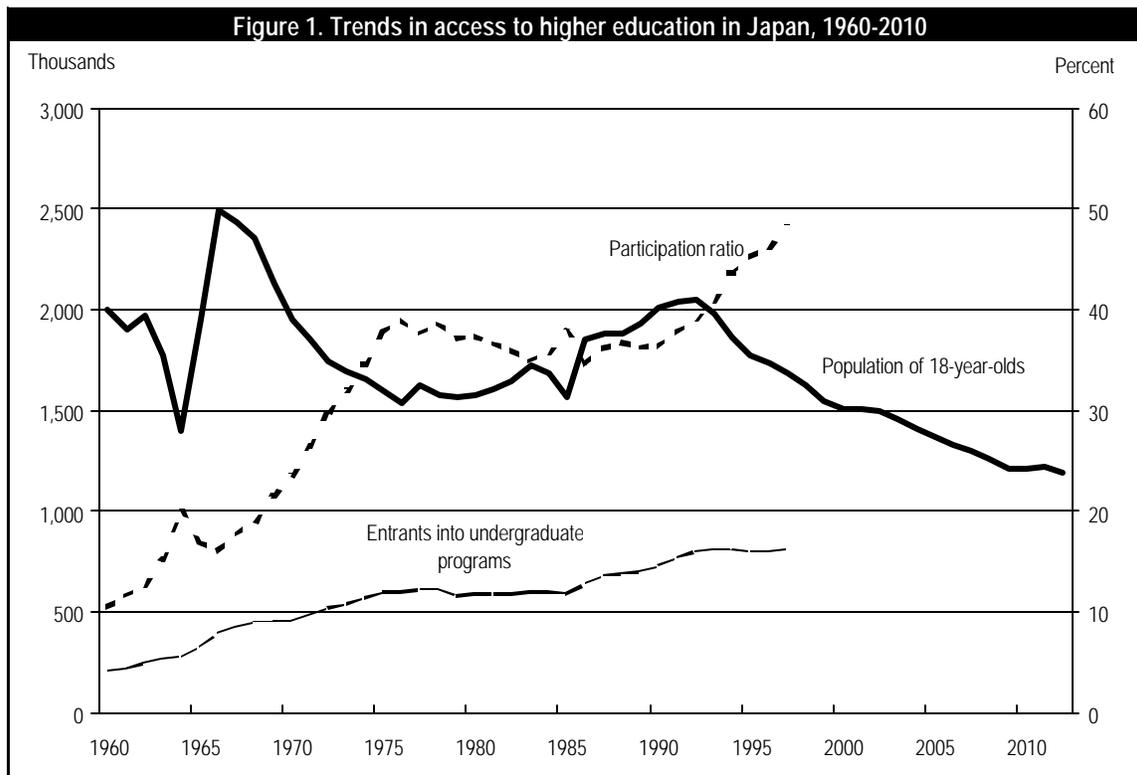
Japan experienced its first period of rapid growth in higher education after World War II in the 1960s and early 1970s. The participation ratio of the 18-year-old population in higher education grew rapidly from only 10.3 percent in 1960 to 38.6 percent in 1976 (figure 1). This growth was caused by various factors (Yamamoto 1997); among them, people’s desire for higher education based on the belief that it would bring great personal benefit and the government’s intention to expand the scale of higher education in science and engineering in response to the need for economic growth. Due to these factors, the proportion of science and engineering students in total enrollment in undergraduate programs grew from 18 percent in 1960 to 23 percent in 1976.

By that time, it was realized that massification brought not only growth of higher education in terms of number of students but also a radical change in the character of the system. Higher education was no longer for the “elite” but was available for the masses. The demand

for education created a diversified system of institutions, ranging from the highly academic to the extremely practical.

In response to this rapid massification and qualitative change in higher education, Monbusho initiated a new policy that was intended to control the quantity and improve the quality of university education in the mid-1970s. Growth in the participation ratio flattened out, and enrollment also stopped growing. This policy, however, actually protected the existing higher education system; real university reform did not begin until the 1990s.

The second stage of massification started at the beginning of 1990s. The participation ratio of 18-year-olds grew again, from 36.3 percent in 1990 to 47.3 percent in 1997. This time, the share of students in science and engineering did not change but remained at around 23 percent. This rapid regrowth was triggered by an increase in the population of 18-year-olds in the late 1980s. This regrowth mechanism can be explained as follows: each university and college tries to expand enrollment when the population of 18-year-olds grows; the government also encourages each institution to accept more students because it is afraid of an increase in the number of people who cannot enroll in universities and colleges. This growth in capacity at each institution encourages 18-year-olds to



SOURCE: The Monbusho Survey of Education.

attend universities and colleges at rates greater than the government anticipated, just as the “multiplier” used in explanations of economic growth. With a mass higher education system, people tend to go to college because their neighbors do.

This second stage of massification, however, was followed by a serious problem. As shown in figure 1, a steady decline in the 18-year-old population—from 2.05 million in 1992 to 1.20 million in 2009—will considerably lower the potential higher education enrollment. Except for a few prestigious institutions, most universities will have to consider how to deal with this future shortage of applicants and how to attract students.

Along with the massification of higher education, a growing number of people have complained about the content of education. Teaching tends to be concentrated on academic material, while many students prefer to take practical courses they think will be useful in future jobs outside academia. Another difficulty is a perceived decline in student interest in learning. Many students who might not have enrolled in higher education 2 decades earlier are not accustomed to studying abstract material in academic language. Universities must respond to this more diversified student population and improve teaching techniques and curriculum. So-called “faculty development” (FD) has become a fashionable phrase in Japan when discussing the improvement of teaching. Along with FD, universities are being forced to reform in response to this new situation, and to attract and retain students.

## THE SYSTEM OF GRADUATE EDUCATION IN JAPAN

The current graduate education system in Japan has been developing since its introduction after World War II. Enrollment in graduate education, though much smaller than in the United States and major European countries, has grown more rapidly than undergraduate enrollment during this period. Now, approximately 10 percent of students (26 percent in science and engineering) who finish undergraduate programs advance to graduate programs.

Graduate schools offer two kinds of programs—a 2-year master’s degree program and a 3-year doctoral program. The doctoral programs generally admit students who finish a master’s degree program. Enrollment in graduate school generally requires the successful completion of a bachelor’s degree. However, a recent reform

enables each graduate school to admit prospective students who have not yet finished their undergraduate program and to grant degrees to those who have completed a shorter coursework program.

Japanese doctoral degrees are classified into two categories. One is the “coursework doctorate” (university-based doctorate), granted to those who finish 3 years of coursework and write a doctoral thesis. The other is the “thesis doctorate” (*Ronbun* doctorate), granted to those employed in industry or others who submit a thesis (based on their industrial research) to graduate schools and pass an examination. The level of both doctorates is the same according to the definition in Monbusho’s Degree Order. However, a thesis doctorate has tended to be recognized as a “grand doctorate” rather than as an alternative to a coursework doctorate. Granting doctorates has sometimes been regarded in academic circles as praise for esteemed scholars for their exceptional work. This notion has tended to prevent academics from viewing doctorates as a “license” for future researchers and has made doctorates difficult to obtain for young people who are in doctoral programs, especially in the humanities and social sciences.

In the sciences, the number of coursework doctorates has traditionally exceeded the number of thesis doctorates; in engineering and medicine, on the other hand, thesis doctorates have exceeded coursework doctorates. With the expansion of university doctoral programs, however, the proportion of university-based engineering degrees has been increasing. By 1992, more doctoral engineering degrees were earned for research within university laboratories than in industrial research laboratories. This increase was partly due to the fact that each graduate school in engineering had encouraged people who had once enrolled in a master’s program to enroll in shorter graduate programs (mostly 1 year) to obtain a doctorate.<sup>1</sup>

Under the Japanese doctorate system, there is no clear distinction between a Ph.D. and a professional doctoral degree. Recipients of either type of degree are called “doctor,” although credentials require indication of a specialty and the name of the university that granted the degree.

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<sup>1</sup>Under the current Japanese system, the minimum coursework requirement for a doctorate is 3 years, including master’s degree coursework. If a person has previously enrolled in a 2-year master’s program or has equivalent ability, the minimum coursework requirement is 1 year.

Graduate schools are quite separate from undergraduate programs. This structural distinction is one of the unique features of the Japanese university system, in contrast to European systems where undergraduate and graduate structures are not so clearly distinguished. The U.S. graduate education system is funded by individual grants; this is unlike Japan's system, where Monbusho provides general university funds to the graduate programs at national universities. Some European countries indicate that they are now looking at the U.S. system of graduate education. One of the biggest problems is that graduate schools are much smaller than undergraduate departments. Most faculty members want to teach at graduate schools while, in reality, they usually have their affiliation

with undergraduate departments and are heavily involved in undergraduate teaching. Faculties have long claimed that graduate schools should be further expanded.

Japanese graduate schools are now aiming to train professionals with advanced specialized skills, as well as train researchers to work in academia and other institutions. Most efforts, however—especially in the humanities and social sciences—have been devoted to training academic researchers. People who want to work for business and government have tended to end their studies at the undergraduate level. This relates to the fact that leading Japanese companies each year have recruited new bachelor's degree recipients of potential ability and given

**Table 1. Master's and doctoral degrees by field in Japan**

Field	1991	1992	1993	1994	1995
	<b>Master's degree</b>				
Total.....	29,550	33,293	37,213	42,015	47,525
Humanities.....	2,348	2,473	2,749	2,947	3,413
Social sciences.....	2,672	3,095	3,613	4,169	5,135
Science.....	3,204	3,504	3,862	4,457	4,946
Engineering.....	14,346	16,309	18,198	20,352	22,610
Agriculture.....	2,028	2,372	2,622	2,971	3,136
Health.....	1,316	1,403	1,659	1,749	1,871
Home economics.....	168	195	221	201	290
Education.....	2,436	2,666	2,850	3,204	3,699
Arts.....	674	730	743	884	985
Others.....	358	546	696	1,081	1,440
	<b>Doctoral degree</b>				
Total.....	10,885	11,576	12,486	13,044	13,632
Coursework doctor total.....	4,779	5,134	5,718	6,203	6,979
Humanities.....	42	56	90	133	147
Social sciences.....	67	90	88	123	174
Science.....	586	638	761	811	908
Engineering.....	983	1,184	1,432	1,613	1,925
Agriculture.....	385	376	446	508	587
Health.....	2,503	2,624	2,670	2,736	2,886
Education.....	25	21	25	24	32
Others.....	188	145	206	255	320
Ronbun doctor total.....	6,106	6,442	6,768	6,841	6,653
Humanities.....	117	149	171	175	198
Social sciences.....	133	153	195	178	184
Science.....	306	371	407	324	335
Engineering.....	1,111	1,178	1,351	1,396	1,372
Agriculture.....	485	448	476	500	521
Health.....	3,853	4,032	4,042	4,125	3,896
Education.....	24	39	47	52	53
Others.....	77	72	79	91	94

SOURCE: The Monbusho Survey of Education.

them long-term in-service training as future managers. Companies do not seek people with specific or advanced skills.

Thus, advancing to graduate programs instead of getting a job after obtaining a bachelor's degree has not been attractive except for those who intended to be university researchers. A few exceptional cases are those holding master's degrees in engineering or doctoral degrees in medicine. The reason for the success of master's programs in engineering was the growing demand for specialized skills in this field when Japan's economy was increasing rapidly. This economic growth triggered policymakers and industry to demand expanded master's programs in engineering. Once prospective students regularly advanced to graduate programs, having a master's degree in engineering gradually became essential for employment in mainstream industry. Today, universities that offer master's degree programs train students intensively for 3 years from their final years in undergraduate programs until the end of the master's course.

Graduate enrollment differs by institution type (national, local, public, and private). The majority of students take their undergraduate courses at private institutions, while national universities exceed others in the scale of graduate education. Similar differences exist among the disciplines (table 2). In the humanities and social sciences, most students leave their institutions with bachelor's degrees; graduate education is very minor compared with the huge scale of undergraduate programs. Advanced

research activities in this group are highly concentrated in a few institutions. More students enter graduate programs in science and engineering. Master's programs in engineering are regarded as the most successful case of graduate education in Japan. Doctoral enrollment in this field is also much greater than in the humanities and social sciences.

## EXPANSION OF GRADUATE EDUCATION

As mentioned above, until the late 1970s, the function of the Japanese graduate education system had been mainly the research training of future academics. In some areas, such as engineering, growing enrollment had gradually changed the character of graduate education—i.e., shifting it from an emphasis on academic research training to professional training. Thus, in the 1970s and 1980s, Monbusho discussed and introduced systemic reforms.

Although graduate education aims at both academic research and professional training, it has been regarded as an important locus of research activity. Due to the massification of university education, concerns about university research have shifted from undergraduate departments to graduate schools. Graduate schools seem to be a sanctuary not only for faculty members who seek the unity of research and teaching, but also for policymakers who regard university research as an engine for economic growth and technological innovation.

**Table 2. Number of students finishing each program, 1997**

By type of institution	Level			
	Undergraduate	Master's programs	Doctoral programs	
Total.....	524,512	50,430	9,860	
National.....	104,100	31,025	7,024	
Local.....	15,808	2,000	446	
Private.....	404,604	17,405	2,390	

By field	Level			Doctorates granted <sup>b</sup>
	Undergraduate	Master's programs	Doctoral programs <sup>a</sup>	
Total.....	524,512	50,430	9,860	12,031
Humanities and social sciences.....	299,324	4,234	1,570	522
Science and engineering.....	136,773	26,393	4,359	4,663
Health.....	23,571	2,033	3,370	6,480
Others.....	64,844	17,770	561	366

<sup>a</sup> Number of students who finished coursework in that year.

<sup>b</sup> Number of doctorates granted in that academic year including both coursework doctorates and ronbun doctorate. It can be seen that there are many students who leave their coursework without receiving a doctorate in the humanities and social sciences.

SOURCE: Monbusho, Basic School

The growing number of graduate students, especially in engineering, has reflected the new expectations of the industrial sector. Master's degree programs have grown far more rapidly than those at the undergraduate level. The proportion of students who advanced from undergraduate to master's degree courses was low even in engineering during the 1960s and early 1970s. By 1996, however, it reached nearly 25 percent; at the University of Tokyo, for example, 69 percent of undergraduate students at the School of Engineering advanced to graduate courses in that year. On the other hand, in the humanities and social sciences, this ratio has remained low.

Although enrollment differs by discipline, graduate education has been closely connected to research intensity at Japanese national universities and is influenced by

university finances. The level of general university funds allocated for each national university from Monbusho differs greatly for universities with master's and doctoral programs. The amount of general university funds allocated for each research unit (*Koza*) that deals with doctoral programs is more than two times greater than that of any type of research unit that has no relation to graduate education (*Gakkamoku*). For private universities and local public universities, doctoral programs bestow a prestigious status upon neighboring institutions, even if they do not attract enough students into their graduate schools.

Thus, graduate education has been expanding not only by responding to growing demand, but also due to the desire of faculties to increase their funding and status. Today, all national universities have at least master's

## INCREASING FLEXIBILITY IN JAPANESE GRADUATE EDUCATION

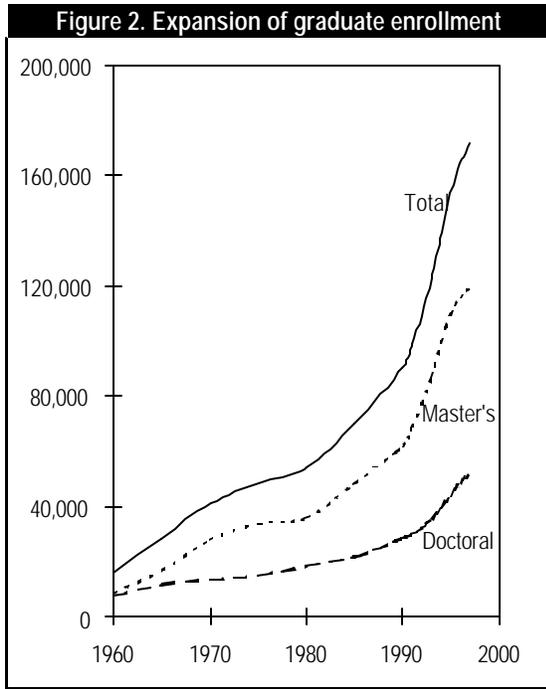
A number of changes have been made with the aim of bringing greater flexibility to the graduate school system since the late 1970s:

1. The aims of doctorate courses have been expanded to include not only the traditional goal of training researchers to work in universities and other institutions, but also the training of professionals with advanced specialized skills that enable them to contribute to various sectors of society.
2. It has become possible to establish evening graduate courses to meet the needs of workers.
3. Graduate schools are now able to reduce the required duration of study for students of exceptional ability.
4. Students in master's degree courses are now able to receive research guidance in other universities and institutions for up to 1 year when this is deemed to be of educational or research benefit.
5. To provide a way for students who show exceptional aptitude for research to begin graduate studies earlier than usual, the system has been altered to allow such students to proceed directly to master's degree course studies after completing the third undergraduate year.
6. Students who have completed their undergraduate programs and have been involved in research at universities or research institutions for at least 2 years are now deemed qualified to enter the upper division of doctorate courses even if they have not completed master's degree courses.
7. In master's degree courses designed primarily to train professionals with advanced specialized skills, the requirements concerning degree theses have been changed to enable the thesis requirement to be waived at the discretion of the graduate school when this is deemed appropriate from an educational viewpoint.
8. People with outstanding knowledge and experience in specialized fields and with advanced abilities in education and research can now be considered qualified to be graduate school teachers. The aim of this change is to attract human resources from nonacademic sectors of society so that people with exceptional knowledge and experience in specialized fields can contribute to graduate education and research.

**SOURCE:** Monbusho (1996).

programs and 80 percent have doctoral programs. As for private universities, 19 percent have master's programs and 47 percent have doctoral programs; just 34 percent have only undergraduate programs. The annual growth of graduate enrollment in Japan was the highest among

industrialized countries in the world. While the United States experienced about 1.8 percent annual growth during the 1980s, Japan's graduate enrollment increased by 5.6 percent.

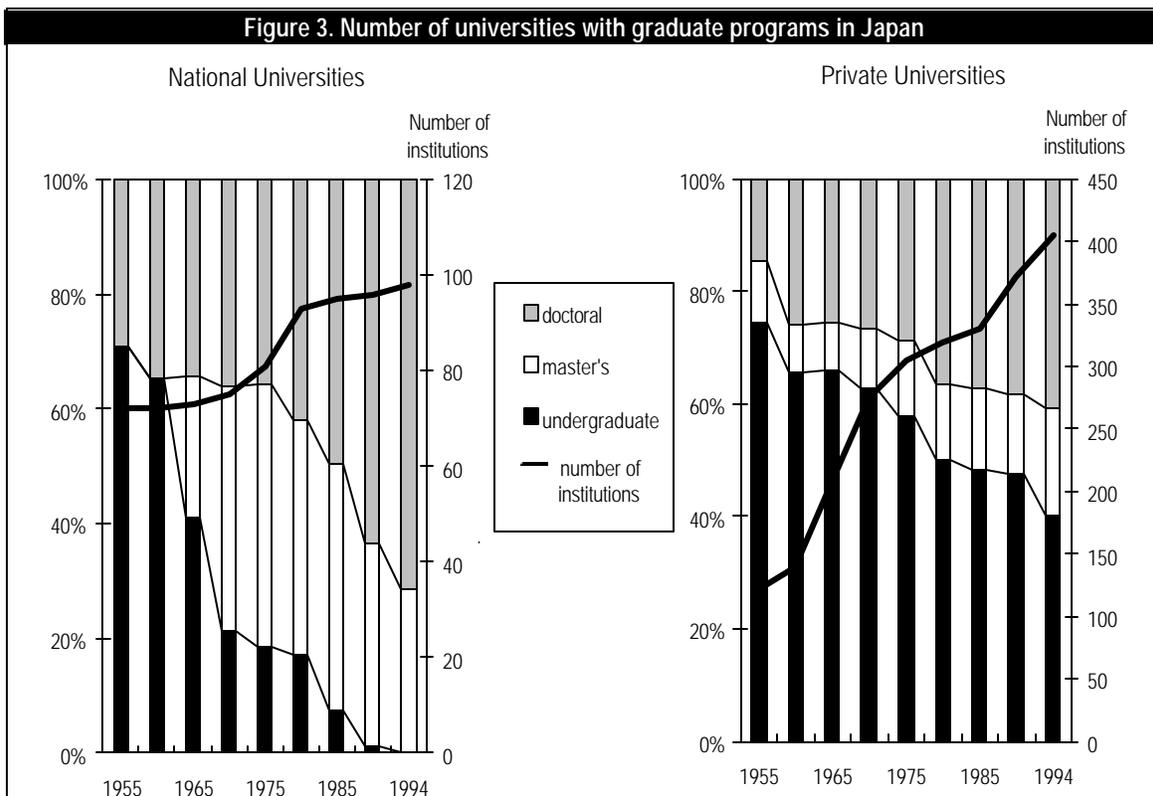


SOURCE: Monbusho, Basic School Survey.

**Table 3. Enrollment in graduate programs in Japan: master's and doctorate, by field, 1960-97**

Field	1960	1970	1980	1990	1997
<b>Master's programs</b>					
Total.....	8,305	27,714	35,781	61,884	119,406
Humanities.....	2,870	5,157	5,469	6,009	10,729
Social sciences.....	2,370	4,607	4,050	6,366	15,380
Science.....	987	2,983	3,741	6,484	12,109
Engineering.....	1,223	10,251	14,864	28,399	51,277
Agriculture.....	372	2,063	2,546	4,046	6,943
Health.....	140	909	1,497	2,710	4,909
Other.....	343	1,744	3,614	7,870	18,059
<b>Doctoral programs</b>					
Total.....	7,429	13,243	18,211	28,354	52,141
Humanities.....	1,016	1,876	2,860	3,594	5,592
Social sciences.....	894	1,727	2,430	2,654	4,830
Science.....	900	2,263	2,589	3,067	5,831
Engineering.....	391	2,356	2,358	4,315	10,847
Agriculture.....	339	839	1,095	1,742	3,632
Health.....	3,709	3,769	6,191	11,794	17,187
Other.....	180	413	688	1,188	4,222

SOURCE: Monbusho, Basic School Survey.



SOURCE: The Monbusho Survey of Education.

# THE SYSTEM FOR SUPPORTING, TRAINING, AND EMPLOYING S&E GRADUATES IN JAPAN

## RESEARCH FUNDING FOR GRADUATE EDUCATION

The growth of general university funds was almost frozen in Japan during the 1980s, due to the governmental budget deficit problem. This situation caused serious problems in graduate education because it had long been maintained by general university funds. However, revitalization of university research was considered critical in promoting advanced research and economic competitiveness. Monbusho also increased other types of research funding other than general university funds. These funds are not formula-based but are provided on a competitive basis. Thus, the structure of university research funding has changed greatly over the last several years. Special funds have been set up for graduate schools (on an institutional basis) as well as for new fellowships for doctoral students and postdoctoral researchers (on an individual basis).

Special budgetary mechanisms are available for graduate schools that are expected to produce outstanding educational or research achievements or that are actively involved in new ventures. In fiscal year 1987, Monbusho established a system for subsidizing advanced equipment for graduate schools with the aim of achieving rapid improvement in the conditions of graduate education and research. Under this system, funds are made available to graduate programs that generate excellent educational and research results. The funds are used to install advanced educational facilities needed by scientific fields and educational activities. In fiscal year 1995, the government allocated 6,343 million yen for this purpose.

A special expenditure system, the *Kodo-ka* fund, was established in fiscal year 1992 to give priority to the advancement of education and research, especially at graduate schools, through support of educational and research activities, including joint research, research exchanges, the use of teaching assistants, and international exchanges. In fiscal year 1995, 9,981 million yen were allocated for this purpose.

The aim of these new policies, along with a growing amount of competitive grant-in-aid programs (*Kaken-hi*), is to give additional resources to selected schools and scholars whose research quality and performance are outstanding. A new funding program, Research for the Future, which began in 1996 and is managed by the Japan Society for the Promotion of Science (JSPS), is funded through capital investments made by the Japanese government to promote and expand the frontiers of scientific research.<sup>2</sup> Funding is decided by the JSPS committee after designation of the specific research fields to be pursued.

In addition, some universities, such as the University of Tokyo, have recently shifted their research units (*Koza*) from undergraduate departments to graduate schools (*Juten-ka*). By doing so, they have succeeded in increasing their research funding by 25 percent from Monbusho. The Center of Excellence program is another example of selective allocation of resources. This program aims to establish a superior research base within a university, and Monbusho provides active support to those institutions recognized as centers of excellence. As a result, the university funding structure has greatly changed from relying on general university funds toward a reliance on specific and competitive funds.

**Table 4. Major funds allocated to national universities**

Type of Funding	Million yen		
	1987	1992	1997
General university fund.....	97,824	117,873	154,052
Grant-in-aid.....	45,080	64,600	112,200
Contract research from industry <sup>a</sup> .....	22,361	48,184	52,783
Contract research from government....	5,451	9,449	41,853

<sup>a</sup> Donations in 1997 included large capital investment funds.

SOURCE: The Monbusho Survey of Education.

## FINANCIAL SUPPORT FOR GRADUATE STUDENTS AND POSTDOCTORAL RESEARCHERS

Financial support for graduate students and postdoctoral researchers is important for research training. For graduate students, scholarship loans provided by the Japan Scholarship Foundation (JSF) have played the

<sup>2</sup>Many efforts have been undertaken to improve the difficult economic situation in Japan. Research as investment has emerged under these circumstances.

biggest role.<sup>3</sup> These loans enable students who lack financial resources to attend graduate schools. More than 40 percent of master's degree program students, and more than 60 percent of doctoral program students, used these loans in the 1970s. Although the growth of JSF scholarship loans did not follow the expansion of the student population (those figures have now declined to 30 percent of master's students and 50 percent of doctoral students), the loans provide basic financial support for graduate students. Students who, upon graduation, are employed in universities or related institutions as researchers for some years do not need to return their scholarship loans.

In 1985, Monbusho established a new and more competitive fellowship program for young researchers, Fellowships for Japanese Young Scientists. With the aim of cultivating young researchers who will conduct innovative and trail-blazing research, this fellowship program provides a limited number of promising young researchers with fellowships and research grants so as to allow them to concentrate on their research, which they conduct in laboratories or under supervising researchers of their choice for a specified period (2 to 3 years). This new fellowship, which is administered by the JSPS, is provided for graduate students and postdoctoral research-

ers on a highly competitive basis. In fiscal year 1997, 2,420 doctoral students and 1,070 postdoctoral researchers were granted this type of fellowship. Thus, competitive funding for individuals has been promoted.

Under the JSPS fellowship program for young Japanese researchers, postdoctoral fellows receive 354,000 yen (approximately US\$3,000) a month, and doctoral students receive 202,000 yen (US\$1,700) a month. Research funding of up to 1.5 million yen is also provided. The JSF provides scholarship loans of 83,000 yen a month for master's degree course students and 115,000 yen a month for doctorate course students. In addition to the fellowship, other types of support are provided through a teaching assistant program and a research assistant (RA) program. Unlike the U.S. system, the RA is directly funded by institutions without a direct link to particular research grants.

As part of the promotion of the Program to Support 10,000 Postdoctorals, which is included in the Science and Technology Basic Plan of 1996, these new kinds of competitive support devices will be expanded not only by Monbusho, but also by other governmental agencies, including the Science and Technology Agency. The target amounts of annual support differ greatly (table 5).

Table 5. Main financial support for graduate students and post-doctoral researchers in 1998				
Sources/mechanisms of support	Graduate students		Post-doctoral	Annual amount of support (1,000 yen)
	Master's	Doctoral		
Total enrollment <sup>a</sup> .....	105,079	38,343		
<b>Monbusho related</b>				
JSF scholarship loans <sup>b</sup> .....	27,210	19,750	NA	MC:996, DC:1,380
JSPS fellowships.....	NA	2,440	1,330	DC:2,424, PD:4,248
Teaching assistantships.....	3,538	6,853	NA	MC,DC: 528
Research assistantships.....	NA	2,562	NA	DC:1,056
Other.....	NA	NA	2,360	NA
<b>STA and other ministries</b>				
Fellowship from STA <sup>c</sup> .....	NA	NA	1,087	from 3,240 to 7,488
Fellowship from MITI <sup>d</sup> .....	NA	NA	133	8,640
Other.....	NA	NA	1,422	NA

<sup>a</sup> Japanese students only.

<sup>b</sup> JSF: The Japan Scholarship Foundation is a JSPS-like special public organization under the umbrella of Monbusho.

<sup>c</sup> STA: Science and Technology Agency.

<sup>d</sup> MITI: Ministry of International Trade and Industry.

**KEY:** NA = not applicable

MC=Master's course, DC=Doctoral course, and PD=Postdoctorate.

**SOURCE:** The Monbusho Survey of Education.

<sup>3</sup>Although scholarships are not considered loans in U.S. terminology, Monbusho considers them so because JSF scholarships (*Shogaku-kin*) should be returned (with some exceptions) under the Japanese system.

## EMPLOYMENT

The labor market for master's students has been generally satisfactory, especially for engineering students. These are hired by various kinds of industries and are playing a key role in the growth of industry and the economy. In contrast, the labor market outlook for doctoral students is not optimistic. One of the biggest markets for doctoral students continues to be the academic sector. This market is going to shrink because of the decline in the population of 18-year-olds. In addition, current economic difficulties make this matter worse because industries are hesitating to hire doctoral degree-holders. The labor market in industry has tended to be in specific fields. Getting a job in industry has continued to be difficult for doctoral students in the humanities and social sciences. Furthermore, the salary for Ph.D.s is almost the same as for people who finish undergraduate programs and enter employment 5 years earlier—that is, a bachelor's degree recipient's salary increases to that of a Ph.D. if he or she continues to work for 5 years at the same company instead of studying at graduate schools for 5 years to get a doctorate.

A March 1997 survey (table 6) of the careers of students who had completed graduate courses showed that of the 50,430 who had completed master's degree courses, 7,992 entered doctorate programs, while 34,223 entered employment. The main industrial sector in which graduates were employed was manufacturing (17,117). A total of 9,860 people had completed doctorate courses. Of these, 6,231 (63.2 percent) entered employment. Although industry was a major employment sector, getting a job at a university was the leader in many fields.

Demand for graduates of master's degree courses in science and engineering is especially high, but there has been a steady rise in demand for graduates in the humanities and for graduates of doctorate courses. There is evidence, however, that society still does not always place a high enough value on graduate school education. Moreover, not all graduate schools have developed educational programs that offer attractive content and provide an appropriate response to current demand.

**Table 6. Employment of graduate students, 1997**

Field	Total	University teaching	Industry total	Manufacturing <sup>a</sup>	School teacher	Health related	Further study	Other <sup>b</sup>
<b>Master's</b>								
Total.....	50,430	536	31,073	17,117	2,080	534	7,992	8,215
Humanities.....	3,723	50	616	72	227	25	1,149	1,656
Social science.....	5,611	58	2,289	320	66	29	1,271	1,898
Science.....	5,267	9	2,985	1,615	184	18	1,529	542
Engineering.....	23,337	56	20,214	12,850	64	23	2,011	969
Agriculture.....	3,056	7	1,835	882	38	17	717	442
Health.....	2,033	91	1,008	802	2	329	398	205
Education.....	4,167	120	747	83	1,430	62	333	1,475
Other.....	3,236	145	1,379	493	69	31	584	1,028
<b>Doctoral</b>								
Total.....	9,860	1,828	2,507	922	49	1,817	35	3,624
Humanities.....	920	210	108	5	19	2	10	571
Social science.....	650	255	66	6	2	1	6	320
Science.....	1,145	116	392	108	14	4	5	614
Engineering.....	2,434	447	1,245	619	6	1	5	730
Agriculture.....	780	123	282	71	4	12	3	356
Health.....	3,370	530	284	88	0	1,796	5	755
Education.....	180	70	21	1	0	0	1	88
Other.....	381	77	109	24	4	1	0	190

<sup>a</sup> Manufacturing is a subset of the "total" in industry.

<sup>b</sup> Other includes nonresponses.

SOURCE: Monbusho, Basic School Survey.

Under these circumstances, Monbusho's University Council now predicts that enrollment in graduate programs—master's and doctoral degrees combined—will increase from 170,000 in 1997 to 250,000 by 2010. In other words, as shown in table 7, the number of graduates in each year will increase from 60,000 to 93,000 or 94,000. As for supply and demand, demand is predicted to exceed supply for master's degrees, while current policies will lead to a supply exceeding demand for doctor-

ates even in science and engineering. The situation in the humanities and social sciences is projected to be much worse. Thus, an emerging policy issue is how to improve the educational and research quality relevant to actual demand and also improve the environment around graduate education that is now poorly organized. In other words, a crucial point for graduate schools will be whether they can produce master's and doctorate degrees attractive to industry, government, and the business world.

**Table 7. University Council estimates for Japan on supply and demand of master's and doctoral students, 1997-2010**

Field	1997	2010 supply		2010 demand	
	Actual	High	Low	High	Low
<b>Master's</b>					
Total.....	50,430	76,561	74,900	79,947	72,635
Humanities.....	3,723	5,612	5,139	4,792	4,537
Social science.....	5,611	10,386	9,281	8,423	7,748
Science.....	5,267	7,612	7,512	8,670	7,780
Engineering.....	23,337	33,428	33,751	40,397	36,211
Agriculture.....	3,056	3,556	4,362	4,918	4,451
Health.....	2,033	3,218	3,158	2,826	2,640
Education.....	4,167	6,643	6,344	5,022	4,779
Other.....	3,236	6,106	5,353	4,899	4,489
<b>Doctoral</b>					
Total.....	9,860	17,974	17,878	12,931	11,957
Humanities.....	920	1,728	1,662	1,110	1,059
Social science.....	650	1,570	1,406	773	742
Science.....	1,145	2,038	2,026	1,667	1,495
Engineering.....	2,434	4,824	4,640	3,774	3,322
Agriculture.....	780	1,555	1,438	1,098	998
Health.....	3,370	4,523	5,135	3,777	3,660
Education.....	180	467	428	212	204
Other.....	381	1,269	1,143	520	477

**NOTE:** "High" is an estimate from recent 10-year trends; "low" is from recent 15-year trends.

**SOURCE:** University Council of Japan.

## JAPANESE EDUCATIONAL REFORM PROGRAMS AS OF AUGUST 1997

### REVITALIZATION OF HIGHER EDUCATION INSTITUTES

- **Implementation of university reform.** Responding to the revision of the National Standards for the Establishment of Universities in 1991 and the initiation of a self-monitoring and self-evaluation system, each university now reviews its education and research system, improves its curriculum as well as its method of education, and actively implements the self-monitoring and self-evaluation system. To further promote university reform, each university will improve its evaluation system by listening to the opinions of outside knowledgeable persons and experts, such as academicians, heads of related municipalities, and representatives of local industry. Each university will continuously review and evaluate reforms and try to publicize as much information as possible, including the results of self-evaluations.
- **Promotion of enrichment in graduate schools and reorganization of undergraduate departments.** Monbusho will examine models of higher education that play a leading role in advanced scientific research and that respond to the global demand for capable individuals while meeting the challenges of decreasing college-age population and changing industrial structure. At the same time, Monbusho will promote enrichment of graduate schools and reorganization of undergraduate departments.

Several reports to the University Council called for reforms in graduate education. These reports included suggestions for “allowing more flexibility in the existing systems of graduate schools” (December 1988), “the improvement and enhancement of graduate schools” (May 1991), and “the quantitative development of graduate schools” (November 1991). Monbusho is using these recommendations to reform the graduate education system. It will also enhance and strengthen graduate schools by establishing postgraduate and nondegree courses for graduates mainly in the field of pioneering and interdisciplinary research.

- **Improvement and enhancement of scholarship loan program.** The scholarship loan program for graduate students will be improved and enhanced to respond to the growing needs for training researchers and specialized professionals.

### TRAINING PROMISING TALENT FOR THE FUTURE ADVANCEMENT OF SCIENCE AND TECHNOLOGY, AND PROMOTION OF SCIENCE AND RESEARCH IN RESPONSE TO SOCIAL NEEDS

- **Promotion of science and technology education to heighten the interest of young students in science and technology.** Monbusho aims to heighten elementary and lower secondary school students’ interest in science and deepen their understanding of technology. It will support educational activities in science and technology for young people by utilizing science museums as well as university museums and by holding exhibitions related to science and technology. Moreover, the ministry will seek to increase the attraction of young people to science and technology through the “science volunteer” system, including the teaching staff of universities and colleges of technology as well as industrial researchers. Science museums’ educational facilities can use these volunteers to give lectures and/or to carry out experiments for students.
- **Cooperative training among universities, institutes, and industry.** Monbusho is promoting internship programs with industry in which students work professionally in their major area for future career purposes. Monbusho will hold discussions between interested parties, including universities, colleges of technology, and industry, as well as knowledgeable persons and experts in technology.

Enrichment of education and research on venture business at institutions of higher education is aimed at training more capable venture business specialists. Monbusho is looking to attract highly qualified people in business into teaching. It is requesting industry's active cooperation with institutes in the areas of personnel interchange, provision of funds, and provision of information on markets and technology.

- **Enhancement of human resources in the science and engineering field.** Monbusho has promised to carry out the reorganization of departments and courses in science and engineering fields, and to promote modernization of educational facilities for laboratory work to enhance innovation in Japanese science and technology in the future. Furthermore, it seeks to support creative education programs that consist of various activities to cultivate students' creativity at universities and colleges of technology, and will disseminate best practices in developing creative human resources.
- **Personnel training and improvement of research environment in response to social needs.** Monbusho has promoted and initiated a 10,000 Postdoctoral Fellowships Program to support innovative young researchers. This will provide for the funding of research assistants within universities and national laboratories. At the same time, it is attempting to create better research environments by improving facilities and equipment. Further, it will allow cooperative relationships with other related ministries and agencies for the joint funding of research projects.
- **Enhancement of competitive funds.** Competitive funds will be enriched to promote inventive and innovative research in institutes. To make the funds distribution process more selective and efficient, Monbusho will promote implementation of prior, midterm, and posterior evaluations by outside organizations; disclosure of evaluation results- and reflection of evaluations on the distribution of funds.

**SOURCE:** Monbusho.

## THE IMPACT OF FINANCING AND SOURCES OF SUPPORT FOR GRADUATE EDUCATION ON TIME TO DEGREE

There are no official statistical data concerning the relation of financing for graduate students to their time to degree in Japan. However, a 1993 survey showed that the biggest reason why students did not continue their doctoral studies was because they had financial problems (Yamamoto 1996).

Regarding time to degree in Japan, there is great diversity by field. There are very few degrees granted compared to enrollment in the humanities and social sciences, while the success rate of degree completions is much higher in the fields of science, engineering, and medicine. In science and engineering, the ratio of doctoral degree granting is reasonably high; the ratio is far lower in the humanities and social sciences (table 9).

This fact reflects the differences in degree granting standards by field—i.e., whether the doctoral degree is a license for researchers or a prize for accomplished re-

searchers in a particular field. Different modes of training may also affect the rate of degree granting. In science and engineering, the laboratory-intensive apprentice mode allows for easier communication between students and mentors, while the latter case is more difficult under the library-intensive individualistic research mode (Gumpert 1993).

## DISTRIBUTION OF DOCTORAL DEGREES WITHIN COUNTRIES AND ABROAD, AND FOREIGN DOCTORAL RECIPIENTS

Monbusho conducts no official survey regarding the number of doctoral degrees granted to Japanese students who study abroad. However, the National Science Foundation's (NSF's) survey on U.S. universities' doctoral grants to foreign students sheds some light on this matter. According to an NSF analysis, "Compared to major Asian countries of origin, the number of students from Japan earning doctoral degrees in the United States is relatively small. Japanese industries often finance advanced training of their employees in U.S. universities for

**Table 8. Sources of financial support for graduate students in Japan, according to a 1993 survey (percentages)**

Field	Parent/spouse	Self-support	JSF's loan	Other scholarship	JSPS fellowship <sup>a</sup>	TA/Ra <sup>a</sup>	Other
<b>Master's</b>							
Total.....	56	11.6	23.8	7.5		0.4	0.6
Humanities.....	46.1	19.4	26.1	6		1.2	1.2
Social science....	46	20	27	6		0.5	0.5
Science.....	55.8	5.4	30.6	7.5		0.7	0
Engineering.....	58.7	10.4	21.7	8.1		0.2	0.8
Agriculture.....	59.5	9.9	22.9	6.8		0.8	0
Health.....	57	5.6	28	9.4		0	0
Education.....	68.8	12.5	12.5	6.3		0	0
Other.....	56	13.6	27.3	2.3		0	0
<b>Doctoral</b>							
Total.....	25.2	19.4	44.3	4.3	4.9	0.4	1.5
Humanities.....	26.3	33.8	33.8	2.5	2.5	0	1.3
Social science....	22.5	28.2	40.8	1.4	4.2	1.4	1.4
Science.....	16.9	10.2	54.2	6.8	11.9	0	0
Engineering.....	25	14.2	44.6	8.2	4.7	0.7	2.7
Agriculture.....	29.7	13.5	56.8	0	0	0	0
Health.....	36	12	48	0	4	0	0
Education.....	10	40	50	0	0	0	0
Other.....	34.3	11.4	40	2.9	8.6	0	2.9

<sup>a</sup> Since JSPS fellowships and teaching assistantships/research assistantships were not fully implemented in 1993, answers for these columns are incomplete.

**NOTE:** Data were compiled from responses to the question, "What is your primary source of support?"

**SOURCE:** Yamamoto, S. Graduate Schools in Japan From the Perspective of Academic Research. *University Studies* 15:1-287, (1996).

**Table 9. Doctorate granting ratio in Japan**

Field	1990	1995	1995-90
	Percent		(Ratio)
Total.....	63.4	67.4	1.1
Humanities.....	3.2	14.0	4.4
Social science.....	13.1	21.4	1.6
Science.....	65.1	68.9	1.1
Engineering.....	70.9	79.9	1.1
Agriculture.....	68.1	69.5	1.0
Health.....	85.2	85.0	1.0
Education.....	12.4	15.0	1.2

**NOTE:** The doctorate granting figures are obtained by dividing the number of doctorates granted by the number of entrants into doctoral programs 5 years before (for health, 4 years before).

**SOURCE:** The Monbusho Survey of Education.

1 to 2 years, but relatively few remain long enough to complete a doctoral program" (NSB 1998). This means that there are relatively few Japanese who obtain doctoral degrees in science and engineering at U.S. universities.

In addition, the author's sample survey of the faculty of Tsukuba University (table 10) shows that there are a substantial number who received degrees from foreign universities in the humanities and social sciences. In

science and engineering, according to the NSF analysis, there are very few faculty members who earned their Ph.D.s at foreign universities. This contrast between the humanities and social sciences on the one hand, and science and engineering on the other, is a reflection of the fact that Japanese universities have tended to decline in the number of doctoral degrees in the humanities and social sciences granted to those who studied in doctoral programs in Japan. As mentioned earlier, it is not easy to change the national attitude toward doctorates in the humanities and social sciences, where a doctorate is perceived more as an award for an established scholar than a license for further research.

## PATTERNS OF INTERNATIONAL MOBILITY

The numbers of Japanese students who study abroad and foreign students who study at Japanese universities are shown in tables 11 and 12. Note that the Japanese students' figures do not exactly reflect the situation of study abroad because they were obtained from emigration data asking about the purpose of travel.

**Table 10. Doctoral degrees of the University of Tsukuba's faculty granted by Japanese and foreign universities (sample survey)**

Field	No doctorate		Granted by Japanese universities		Granted by foreign universities	
	Professor	Associate professor or below	Professor	Associate professor or below	Professor	Associate professor or below
Humanities total.....	40	84	28	14	10	17
Philosophy.....	5	5	4	2	1	2
History.....	6	18	16	6	2	5
Literature.....	15	29	5	4	4	4
Language.....	14	32	3	2	3	6
Social science total.....	22	26	33	35	21	20
Social sciences.....	19	19	10	12	3	4
Political sciences.....	3	7	23	23	18	16
Natural sciences total.....	0	5	73	176	3	5
Biology.....	0	0	17	37	1	0
Mathematics.....	0	3	15	28	0	0
Physics.....	0	0	19	53	0	2
Chemistry.....	0	1	9	26	1	1
Geosciences.....	0	1	13	32	1	2
Engineering total.....	0	4	70	127	7	9
Applied physics.....	0	0	16	33	4	3
Material science.....	0	0	16	31	0	0
Engineering mechanics...	0	2	16	26	1	1
Electrical engineering.....	0	2	22	37	2	5

SURVEY: Survey of University of Tsukuba's faculty by Yamamoto.

Since the mid-1980s, Monbusho has been implementing the 100,000 Foreign Students Plan, which aims to increase the number of students from abroad to 100,000 by the year 2001. This goal assumes the acceptance of 30,000 students at the graduate school level. As of May 1997, about 20,000 foreign students were studying at graduate schools in Japan, while 32,000 were studying in undergraduate programs. The attainment of 100,000 students by the beginning of the 21st century now seems unrealistic due to the economic recession in Japan and other Asian countries. However, Monbusho thinks it is important to improve admission systems for foreign students, especially at the graduate level, from the viewpoint of promoting international exchanges in education as part of Japan's efforts to make an international contribution appropriate to its rising international status.

Education and research guidance for foreign students must reflect those students' needs. Some universities are actively facilitating the admission of foreign students through measures that include the expansion of Japanese language education programs, the introduction of

**Table 11. Number of Japanese students studying abroad, 1990 and 1995**

Country	1990	1995
Total.....	29,216	59,468
Australia.....	218	675
Austria.....	196	251
Canada.....	312	774
China.....	806	8,526
France.....	863	1,157
Germany.....	1,200	1,236
South Korea.....	562	392
U.K.....	657	2,042
United States....	24,000	43,770
Other.....	402	645

SOURCE: The Monbusho Survey of Education (from data of the Ministry of Justice).

**Table 12. Number of foreign students studying at Japanese universities and colleges, 1960-97**

Year	Total	Under-graduate	Graduate	Junior colleges
1960.....	4,703	3,874	557	272
1970.....	10,471	7,730	1,857	884
1980.....	15,008	10,913	2,644	1,451
1990.....	38,444	23,571	12,306	2,567
1997.....	55,114	32,432	20,051	2,631

SOURCE: The Monbusho Survey of Education.

instruction in foreign languages, and provision for these written in foreign languages. Efforts are also being made to improve education and research guidance systems in graduate departments to which large numbers of foreign students have been admitted. Measures in this area include the appointment of more teaching staff to research programs.

## CURRENT SITUATION OF KOREAN GRADUATE EDUCATION AND ITS REFORM

### HIGHER EDUCATION AND THE GRANTING OF DEGREES

There are numerous similarities in the school systems of Japan and the Republic of Korea. In both countries, a linear school system of the 6-3-3-4 type has been adopted. This means Korea has a school system with 6 years of elementary school, 3 years of middle school, 3 years of high school, and 4 years of university or college. Every citizen who finishes upper secondary school (high school) is eligible to apply for admission to institutes of higher education. Institutes of higher education in the

Republic of Korea are classified into four categories: (1) colleges and universities offering 4-year undergraduate programs (medical and dental colleges, 6 years); (2) 2- to 3-year junior colleges; (3) universities of education; and (4) miscellaneous schools.

Among those higher education institutions, 4-year colleges and universities may have graduate schools. Enrollment in graduate schools is shown in Table 13. These are classified into three types in accordance with their functions and goals: professional graduate schools, general graduate schools, and open graduate schools. This situation differs from Japanese graduate education, which has no formal classifications and in which academic research and professional training are not separated within a single system.

Professional graduate schools prepare students for professional careers in education, business administration, public administration, and other fields. The academic degree that the professional graduate schools confer is a professional master's degree. General graduate schools aim to foster creativity, initiative, and leadership in specialized academic disciplines. General graduate schools award a master of arts or master of science to those who complete the graduation requirements. Students in doctoral programs at general graduate schools must have a master's degree or equivalent, a scholarly background in their field of specialization with some demonstrated research experience, and recommendations from individuals in their field of specialization. Doctoral degrees are shown in Table 14.

### DEVELOPMENT AND REFORM OF HIGHER EDUCATION

The current higher education system was introduced after the establishment of the Republic of Korea in 1948

**Table 13. Enrollment in Korean graduate schools, as of 1997**

Field	Grand total	Master's degree course			Doctoral course
		Total	General	Professional	
Total.....	151,358	128,097	60,634	67,463	23,261
Humanities.....	15,323	12,669	6,454	6,215	2,654
Social sciences.....	36,251	32,639	9,674	22,965	3,612
Natural sciences.....	50,802	39,778	29,377	10,401	11,024
Medical and pharmacy.....	13,010	8,512	7,022	1,490	4,498
Arts and physical education....	8,502	8,021	4,907	3,114	481
Teaching profession.....	27,470	26,478	3,200	23,278	992

SOURCE: Korean Ministry of Education, *Statistical Yearbook of Education* (Seoul, 1998).

**Table 14. Granting of doctoral degrees at Korean universities, March 1996 to February 1997**

Total.....	2,713
Humanities.....	700
Social sciences.....	649
Natural sciences.....	2,444 <sup>a</sup>
Medical and pharmacy.....	1,120
Arts and physical education.....	100
Teaching profession.....	144

<sup>a</sup> Doctorates in engineering total 1,420 and are included with natural sciences.

**SOURCE:** Korean Ministry of Education, *Statistical Yearbook of Education*, Seoul, 1998.

under the strong influence of the American system. After going through hard times, the Korean higher education system experienced a large quantitative expansion in the 1960s and 1970s owing to remarkable economic progress. Following a rapid expansion as in Japan, Korean education endeavored to emphasize and enhance the quality of education, and the Fifth Republic clearly established in the constitution the institutionalization of life-long education. In addition, the republic set as one of the nation's top priorities the formation of a sound personality through education and reform of civil education, emphasizing science and life-long education.

In March 1985, the Presidential Commission on Educational Reform was established under the direct supervision of the president.<sup>4</sup> To achieve the goal, set forth in a 1992-96 plan, of Educating Koreans as the Prospective Leaders for the 21st Century, the commission carried out extensive studies through December 1987 and recommended various kinds of reform measures, including reform of the school system, development of high-level manpower in science and technology, and a drastic increase in educational investment. The recommendations were adopted and enacted consecutively; later, in May 1988, the Advisory Council for Educational Policy was inaugurated as an advisory council to the minister of Education.

The 1990s have witnessed advances in education through the realization of quality education and educational welfare. A particular concern is the pursuit of qualitative, rather than quantitative, growth. The above-referenced plan of Educating Koreans as the Prospective Leaders for the 21st Century exemplifies the goals of Korean education.

<sup>4</sup>Incidentally, Japan also established a National Council on Educational Reform during the same period (1984-87) under the strong initiative of Prime Minister Nakasone; the recommendations of the council still have a strong influence on current educational reform in Japan.

In response to the growing importance of science and technology, the Ministry of Education recently initiated a discussion on the further reform of the graduate education system in Korea, which aims at further supporting leading graduate schools by a reallocation of resources.

## FOREIGN STUDENTS IN KOREA AND KOREAN STUDENTS IN FOREIGN COUNTRIES

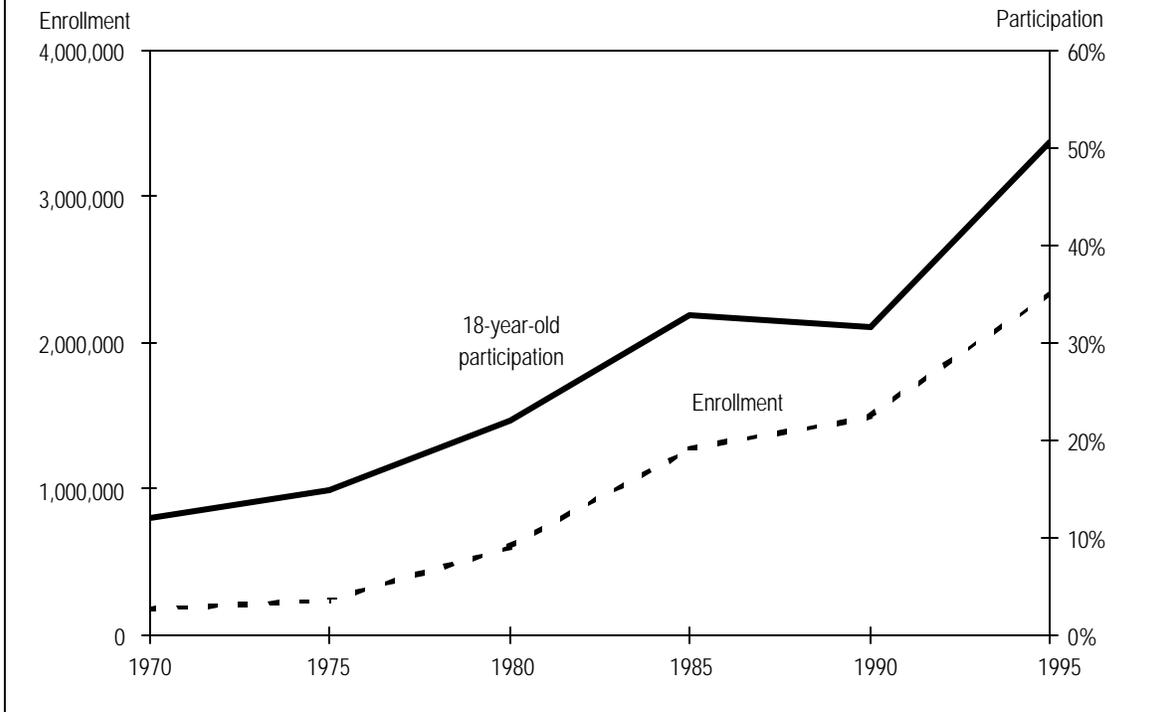
The number of international students attending higher educational institutes in Korea has increased steadily in recent years. As of June 30, 1996, the total stood at 2,143. (see Table 15.) By type of educational institution, about 40 percent of these foreign students attended graduate schools at universities; the rest attended undergraduate and other courses.

One of the features of doctorate granting for Koreans is that a relatively high percentage is granted Ph.D.s by foreign universities. For example, there were 1,004 Koreans who obtained doctorates in science and engineering at U.S. universities in 1995, compared to 2,444 science and engineering doctorates awarded by Korean universities in the following year (see table 14 and NSB 1998). This is a great contrast to Japan's situation, where 4,540 doctorates were awarded at Japanese universities in 1995, while only 154 Japanese obtained doctorates in science and engineering at U.S. universities that same year (see table 1 and NSB 1998). Table 16 indicates similar degree-earning tendencies regarding Korean university faculties, although the data are not very recent.

## CONCLUSION

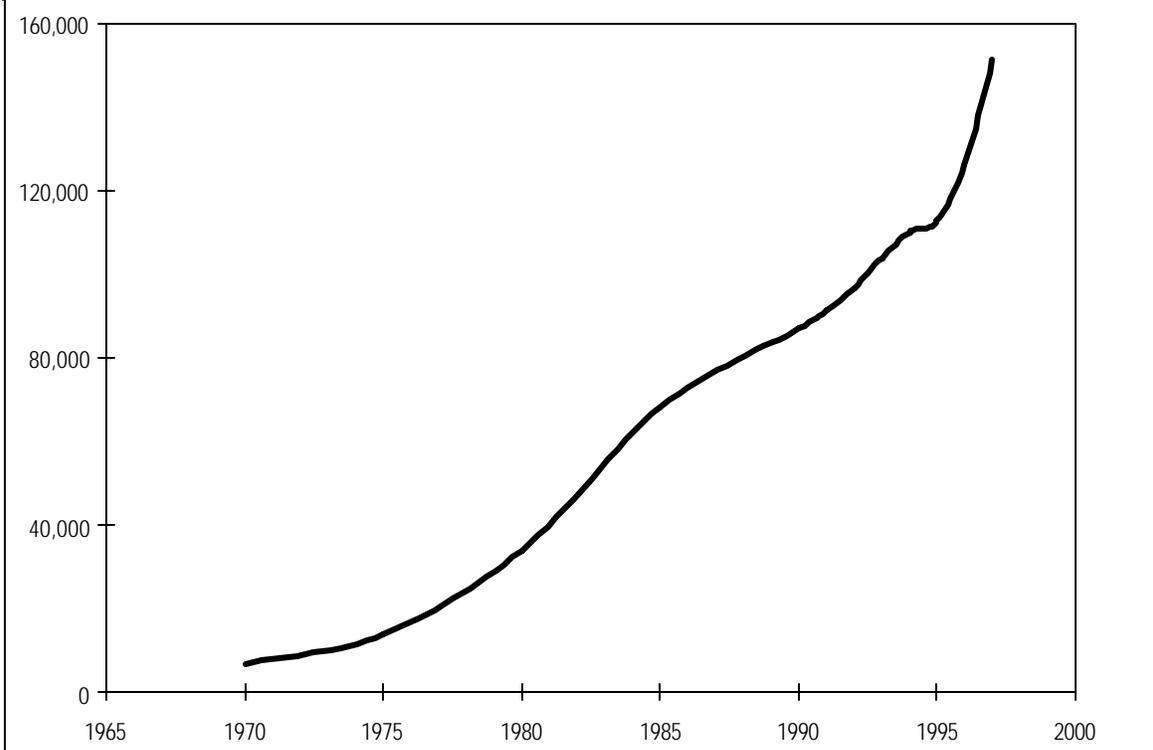
Japan and Korea are now making efforts to adjust their graduate education systems to global levels and quality standards, under the pressures of the ongoing massification of higher education and of international competition in scientific research. Both countries have confronted the growing impact of Western culture and civilization since the latter part of the 19th century and have tried to establish their own higher education and scientific research systems. The establishment of the Imperial University at Tokyo in 1886 was one of Japan's strong responses.

Figure 4. The massification of Korean higher education



SOURCE: Korean Ministry of Education, *Statistical Yearbook of Education*. Annual Series.

Figure 5. Graduate enrollment in Korea, 1970-97



SOURCE: Korean Ministry of Education, *Statistical Yearbook of Education*. Annual Series.

**Table 15. Foreign students at Korean universities**

Nationality	Total	Undergraduate	Graduate	Others
Total.....	2,143	1,279	803	61
Argentina.....	49	44	4	1
Canada.....	58	27	31	0
China.....	486	181	291	14
Germany.....	14	9	5	0
Japan.....	395	242	149	4
Malaysia.....	130	99	1	30
Paraguay.....	28	27	1	0
Taiwan.....	444	398	37	9
United States.....	299	130	169	0
Others.....	240	122	115	3

SOURCE: Korean Ministry of Education, *Statistical Yearbook of Education* (Seoul, 1998).

**Table 16. Origins of university faculty doctorates by country and field, 1983 (percentages)**

Field	Korea	North America	Europe	Asia	Others
Total.....	61.1	21.9	8.7	8.0	0.3
Humanities.....	39.2	38.3	15.7	6.5	0.3
Social sciences.....	47.2	36.4	11.6	4.7	0.2
Science.....	53.5	29.7	6.0	9.4	0.4
Engineering.....	56.8	19.1	10.3	13.6	0.2
Linguistics.....	60.1	14.1	18.9	6.6	0.1
Business administration.....	65.5	26.1	5.4	3.0	0.0
Arts and physical education.....	24.6	60.7	11.5	3.3	0.0
Fishery.....	53.0	6.1	19.7	21.2	0.0
Medicine.....	90.2	3.7	1.6	4.4	0.1
Agriculture.....	63.4	14.7	3.9	17.1	0.9

SOURCE: Lee, S.H., "The Emergence of Modern Universities in Korea," in P.G. Altbach, ed., *From Dependence to Autonomy: The Development of Asian Universities*, pp. 312-47 (1993).



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